

**Astrid Kander.** *Economic Growth, Energy Consumption and CO2 Emissions in Sweden, 1800-2000.* Stockholm: Almqvist and Wiksell International, 2002. 266 pp. SEK 261.00, paper, ISBN 978-91-22-01973-2.



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Astrid Kander's thesis, an in-depth brochure on historical energy use for Sweden, was published as volume 19 of Lund Studies in Economic History. An extensive introduction provides a comprehensive overview on the concept underlying the book and on the research questions addressed. Kander places her work in relation to current positions in economic and environmental history and, with reference to Donald Worster, she contributes to exploring the physical relations of man and nature. The next six chapters present a rich and extensive empirical study on biophysical aspects of two hundred years of economic history for Sweden. These chapters are clearly organized according to Kander's main research questions, each ending with a set of specific conclusions. The last chapter summarizes the main results and draws conclusions for further research. A substantial annex offers supplementary insights into methodological details and provides a large amount of empirical data.

The book's first objective is to provide an empirical database on energy consumption in Sweden. Obviously, this data compilation reflects a

huge effort and extends mainstream approaches of energy accounting by including "traditional" energy carriers such as firewood and food/feed for human and animal work. These features of energy use are often neglected due to a lack of statistical data. Nonetheless, they are of crucial importance with respect to the functioning and understanding of pre-industrial energy systems. In general, the book is very clear with respect to data sources, calculation methods, and modeling assumptions. What would help the reader to interpret the results would be a more explicit discussion of system boundaries of the accounting framework and a more precise definition of "energy consumption" with respect to mainstream terminology in this field (e.g. the distinction between primary energy, final energy, and useful energy).

Based on these data, further chapters analyze and discuss various aspects of the long-term relationships of energy consumption and economic growth for the Swedish case. The focuses are developments of energy intensity and CO2 intensity (i.e. energy consumption per GDP). The book ex-

amines the argument of the Environmental Kuznet's Curve (EKC) which states that relative environmental pressures increase up to a certain level of income after which a delinking of GDP and energy can be observed. Especially the long-term perspective and the broader understanding of "energy" allows the book to gain valuable insights into this inter-relationship. The book reveals that energy intensity in Sweden was declining dramatically over the whole period of time while (fossil) CO<sub>2</sub> intensity shows a typical EKC pattern with a peak value in the 1950s being an effect of substitution of energy carriers and related decarbonisation.

The analysis goes further than just describing changes in energy consumption and energy intensity and related CO<sub>2</sub> emissions. An important issue addressed is whether or not the decrease in energy intensity is due to a shift from energy intensive domestic production to imports of goods. This issue is crucial, but the analysis of trade patterns and the quantification of the energetic upstream flows related to trade goods lack transparency with regards to the methods used for calculating indirect energy flows. This, however, would have an essential influence on the results of such an analysis.

The book searches for the driving forces of the observed development of energy consumption and intensity. Analysing the inter-relationship of energy and economic growth on the level of economic sectors allows us to quantify the relative contribution of either sectoral or technical change to the decrease in energy intensity. Questions such as the effect of the transition to services or the technical improvement in the transportation sector are discussed in order to portray the impact of such changes on overall energy intensity.

Another important aspect discussed in detail is the impact of shifts in the composition of energy carriers and their respective energy quality in changing energy and CO<sub>2</sub> intensity. The study shows that energy quality—which is measured by

the costs of energy carriers—is of minor importance with regard to the decrease in energy intensity but of significant relevance with respect to CO<sub>2</sub> intensity. The last chapter discusses the ways in which Swedish forests function historically as a sink or as a source for carbon. This question is of considerable relevance for environmental policy such as the Kyoto Protocol. The findings indicate that decreases in timber stock during the nineteenth century caused net emissions of CO<sub>2</sub> larger than those emissions coming from fossil fuels. However, due to augmentation of standing timber in the twentieth century the net contribution from forests is almost zero in the long run.

The book tackles the above questions generally in a sound manner as well as presenting and discussing innovative approaches and methods. What makes the book more valuable for scholars is the extensive data and the annex, which provide a wealth of empirical data in time series, including data on energy consumption (some of them at a sectoral level), as well as results for energy and CO<sub>2</sub> intensity. These data sets are extremely useful for a broad range of research questions and contribute to an empirical environmental history research. Some of the tables, however, are not clearly arranged and lack information the reader might wish to see. All in all, Astrid Kander's work is an excellent example of empirical research in environmental history and on how a long-term perspective can contribute to current discussions on sustainable development. As the book is a published thesis, it is detailed in methodological aspects and presents a rich amount of empirical data. This makes it extremely valuable for researchers who work in this particular field of environmental history. However, the reader might find that the readability suffers from this format and a wider audience might be more interested in the summary where general conclusions are drawn.

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